FIG.1

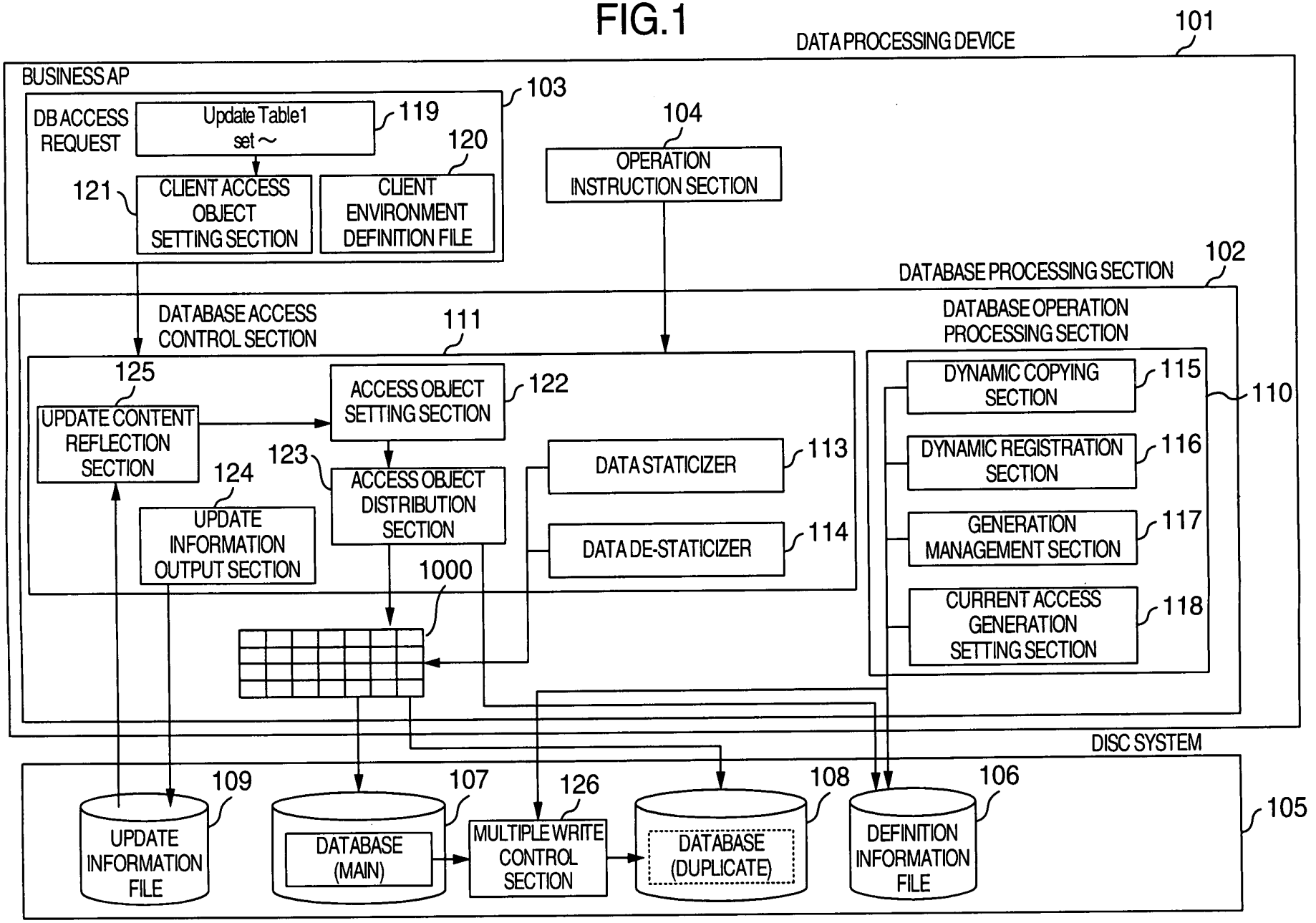
DATA PROCESSING DEVICE
101
BUSINESS AP
103
DB ACCESS REQUEST
Update Table1 set ~
119
120
121
CLIENT ACCESS OBJECT SETTING SECTION
CLIENT ENVIRONMENT DEFINITION FILE
104
OPERATION INSTRUCTION SECTION
102
DATABASE PROCESSING SECTION
DATABASE ACCESS CONTROL SECTION
111
DATABASE OPERATION PROCESSING SECTION
125
UPDATE CONTENT REFLECTION SECTION
ACCESS OBJECT SETTING SECTION
122
123
ACCESS OBJECT DISTRIBUTION SECTION
124
UPDATE INFORMATION OUTPUT SECTION
DATA STATICIZER
113
DATA DE-STATICIZER
114
1000
DYNAMIC COPYING SECTION
115
DYNAMIC REGISTRATION SECTION
116
GENERATION MANAGEMENT SECTION
117
CURRENT ACCESS GENERATION SETTING SECTION
118
110
DISC SYSTEM
109
UPDATE INFORMATION FILE
107
DATABASE (MAIN)
126
MULTIPLE WRITE CONTROL SECTION
108
DATABASE (DUPLICATE)
106
DEFINITION INFORMATION FILE
105

FIG.2

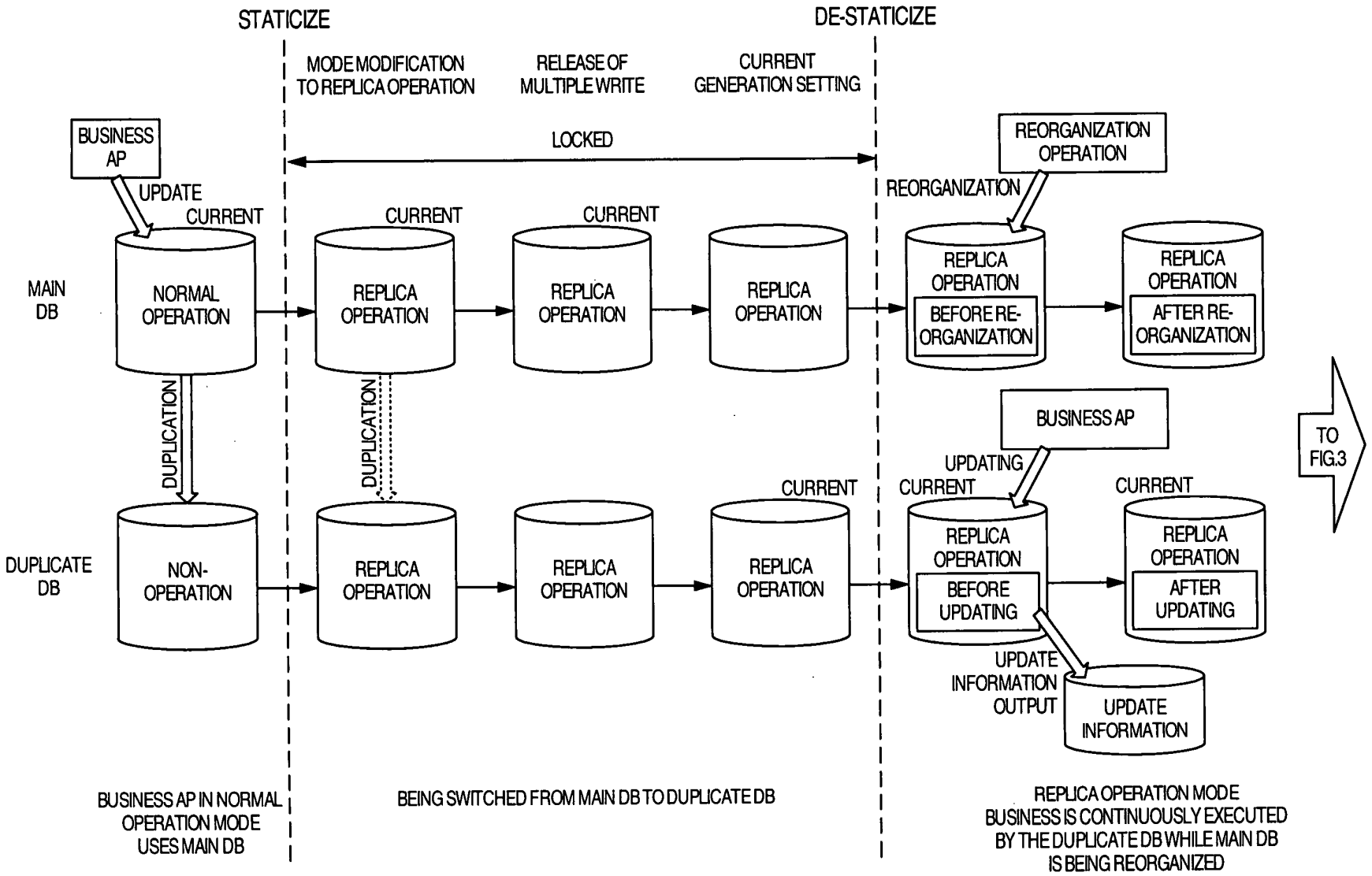
STATICIZE
DE-STATICIZE
MODE MODIFICATION TO REPLICA OPERATION
RELEASE OF MULTIPLE WRITE
CURRENT GENERATION SETTING
BUSINESS AP
LOCKED
REORGANIZATION OPERATION
UPDATE
REORGANIZATION
CURRENT
CURRENT
CURRENT
MAIN DB
NORMAL OPERATION
REPLICA OPERATION
REPLICA OPERATION
REPLICA OPERATION
REPLICA OPERATION
BEFORE RE-ORGANIZATION
REPLICA OPERATION
AFTER RE-ORGANIZATION
DUPLICATION
DUPLICATION
BUSINESS AP
UPDATING
CURRENT
CURRENT
CURRENT
DUPLICATE DB
NON-OPERATION
REPLICA OPERATION
REPLICA OPERATION
REPLICA OPERATION
REPLICA OPERATION
BEFORE UPDATING
REPLICA OPERATION
AFTER UPDATING
UPDATE INFORMATION OUTPUT
UPDATE INFORMATION
TO FIG.3
BUSINESS AP IN NORMAL OPERATION MODE USES MAIN DB
BEING SWITCHED FROM MAIN DB TO DUPLICATE DB
REPLICA OPERATION MODE BUSINESS IS CONTINUOUSLY EXECUTED BY THE DUPLICATE DB WHILE MAIN DB IS BEING REORGANIZED

FIG.3

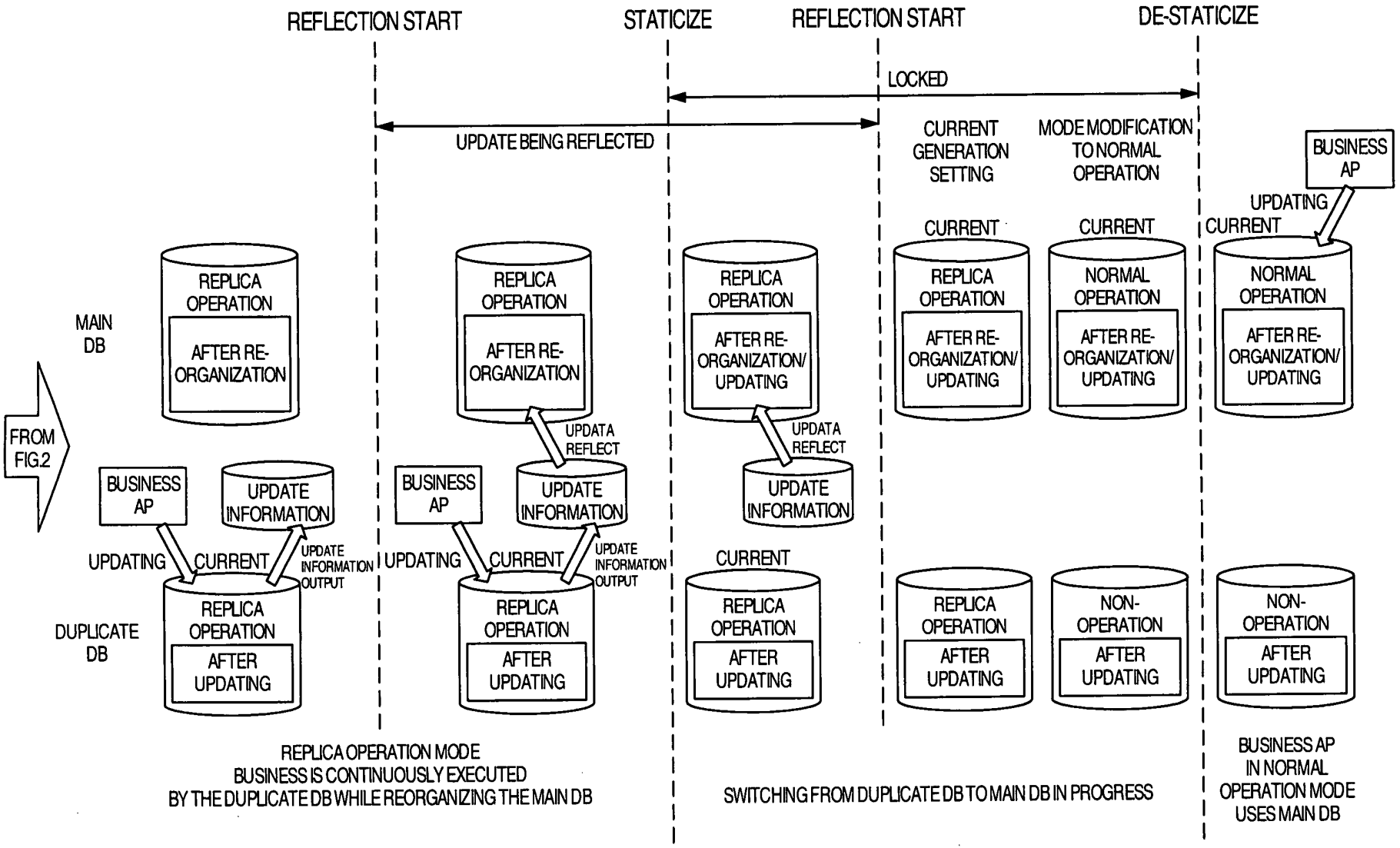
REFLECTION START
STATICIZE
REFLECTION START
DE-STATICIZE
LOCKED
UPDATE BEING REFLECTED
CURRENT GENERATION SETTING
MODE MODIFICATION TO NORMAL OPERATION
BUSINESS AP
UPDATING
CURRENT
CURRENT
CURRENT
MAIN DB
REPLICA OPERATION
AFTER RE-ORGANIZATION
REPLICA OPERATION
AFTER RE-ORGANIZATION
REPLICA OPERATION
AFTER RE-ORGANIZATION/ UPDATING
REPLICA OPERATION
AFTER RE-ORGANIZATION/ UPDATING
NORMAL OPERATION
AFTER RE-ORGANIZATION/ UPDATING
NORMAL OPERATION
AFTER RE-ORGANIZATION/ UPDATING
FROM FIG.2
UPDATA REFLECT
UPDATA REFLECT
BUSINESS AP
UPDATE INFORMATION
BUSINESS AP
UPDATE INFORMATION
UPDATE INFORMATION
UPDATING
CURRENT
UPDATE INFORMATION OUTPUT
UPDATING
CURRENT
UPDATE INFORMATION OUTPUT
CURRENT
DUPLICATE DB
REPLICA OPERATION
AFTER UPDATING
REPLICA OPERATION
AFTER UPDATING
REPLICA OPERATION
AFTER UPDATING
REPLICA OPERATION
AFTER UPDATING
NON-OPERATION
AFTER UPDATING
NON-OPERATION
AFTER UPDATING
REPLICA OPERATION MODE
BUSINESS IS CONTINUOUSLY EXECUTED
BY THE DUPLICATE DB WHILE REORGANIZING THE MAIN DB
SWITCHING FROM DUPLICATE DB TO MAIN DB IN PROGRESS
BUSINESS AP
IN NORMAL
OPERATION MODE
USES MAIN DB

FIG.4

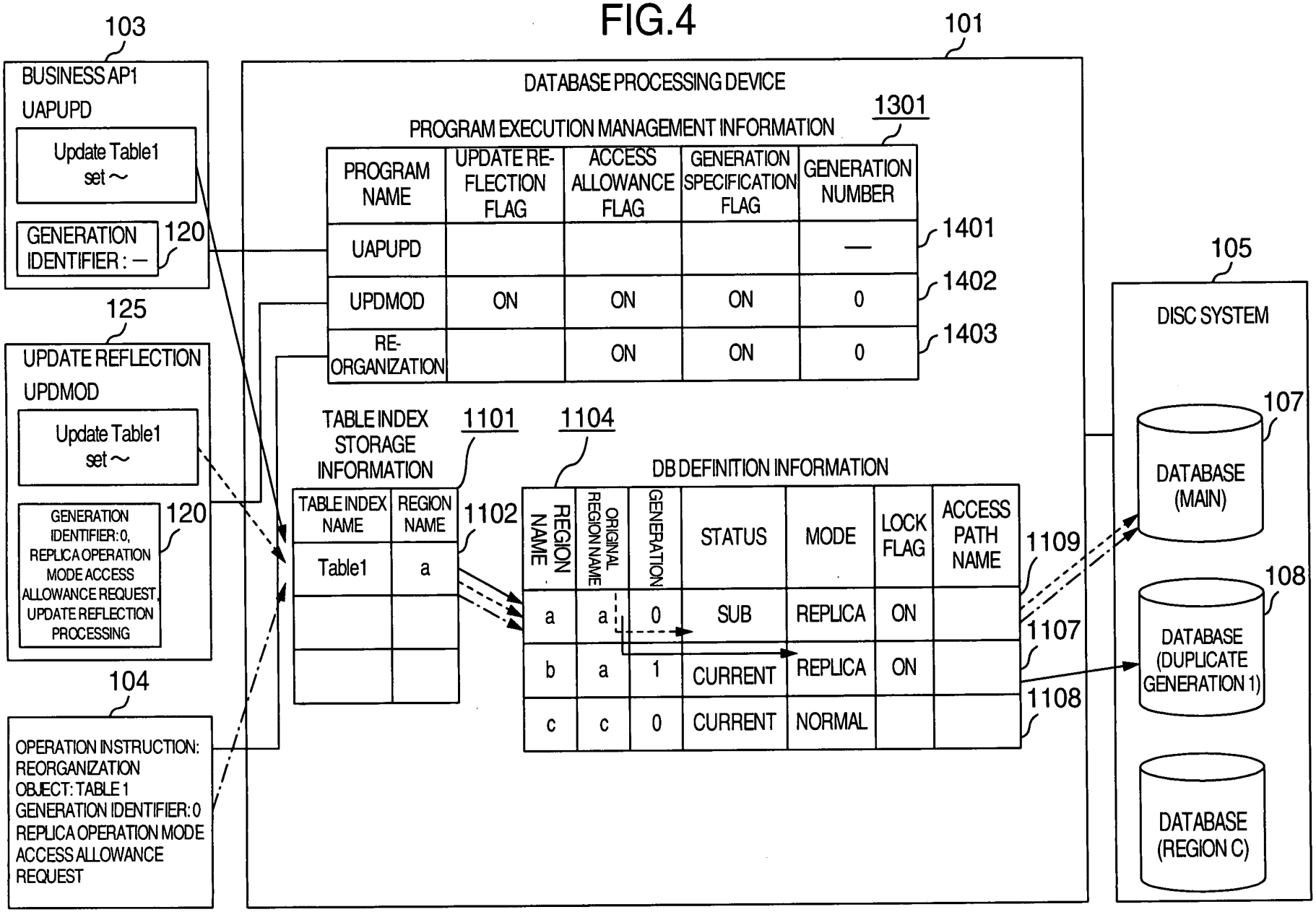
103
BUSINESS AP1
UAPUPD
Update Table1
set ~
GENERATION IDENTIFIER : —
120
125
UPDATE REFLECTION
UPDMOD
Update Table1
set ~
GENERATION IDENTIFIER: 0, REPLICA OPERATION MODE ACCESS ALLOWANCE REQUEST, UPDATE REFLECTION PROCESSING
120
104
OPERATION INSTRUCTION: REORGANIZATION OBJECT: TABLE 1 GENERATION IDENTIFIER: 0 REPLICA OPERATION MODE ACCESS ALLOWANCE REQUEST
101
DATABASE PROCESSING DEVICE
1301
PROGRAM EXECUTION MANAGEMENT INFORMATION
PROGRAM NAME | UPDATE RE-FLECTION FLAG | ACCESS ALLOWANCE FLAG | GENERATION SPECIFICATION FLAG | GENERATION NUMBER
UAPUPD | | | | —
UPDMOD | ON | ON | ON | 0
RE-ORGANIZATION | | ON | ON | 0
1401
1402
1403
TABLE INDEX STORAGE INFORMATION
1101
TABLE INDEX NAME | REGION NAME
Table1 | a
1102
1104
DB DEFINITION INFORMATION
REGION NAME | ORIGINAL REGION NAME | GENERATION | STATUS | MODE | LOCK FLAG | ACCESS PATH NAME
a | a | 0 | SUB | REPLICA | ON |
b | a | 1 | CURRENT | REPLICA | ON |
c | c | 0 | CURRENT | NORMAL | |
1109
1107
1108
105
DISC SYSTEM
107
DATABASE (MAIN)
108
DATABASE (DUPLICATE GENERATION 1)
DATABASE (REGION C)

FIG.5

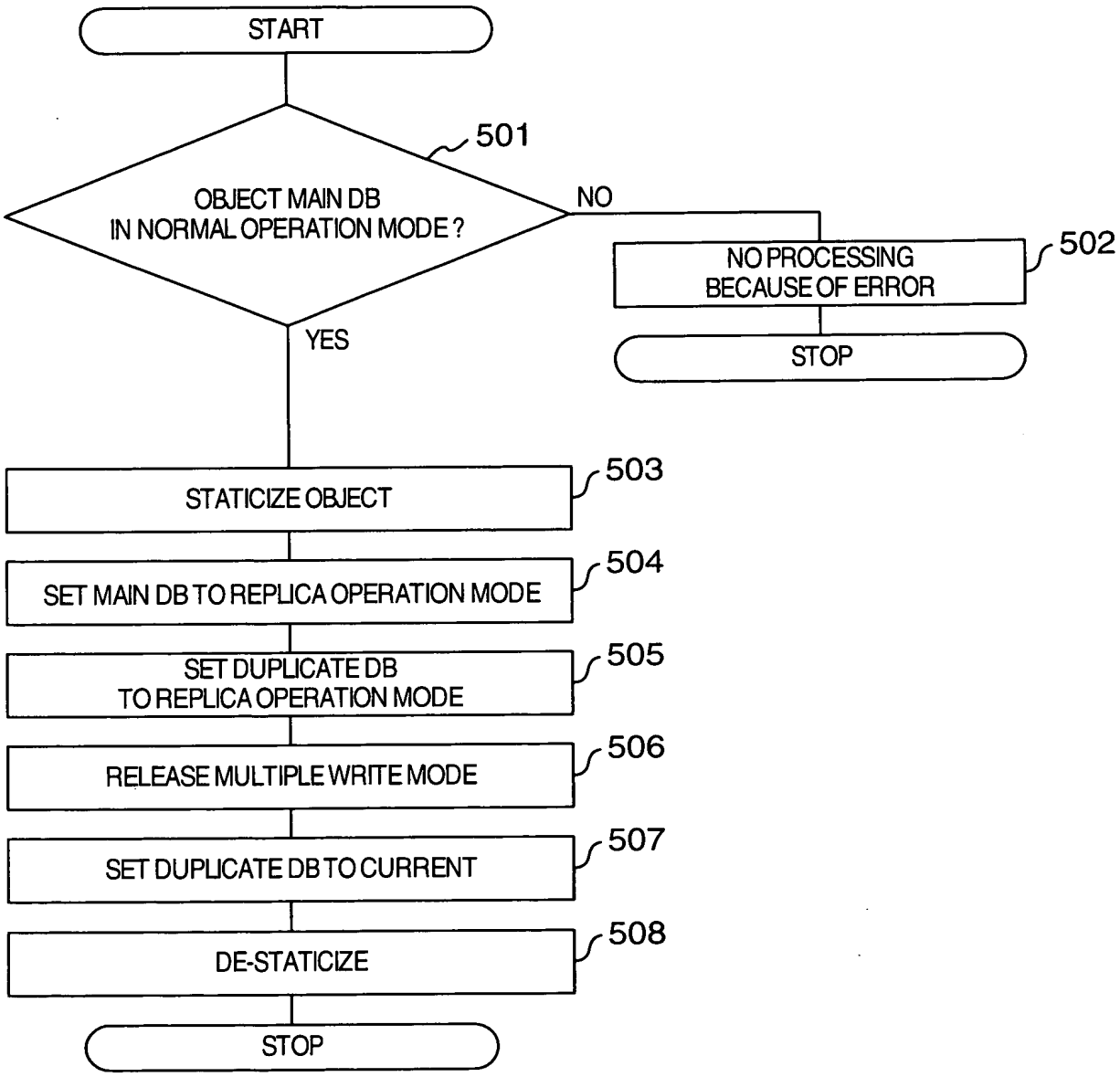
START
501
OBJECT MAIN DB
IN NORMAL OPERATION MODE ?
NO
NO PROCESSING
BECAUSE OF ERROR
502
STOP
YES
STATICIZE OBJECT
503
SET MAIN DB TO REPLICA OPERATION MODE
504
SET DUPLICATE DB
TO REPLICA OPERATION MODE
505
RELEASE MULTIPLE WRITE MODE
506
SET DUPLICATE DB TO CURRENT
507
DE-STATICIZE
508
STOP

FIG.6

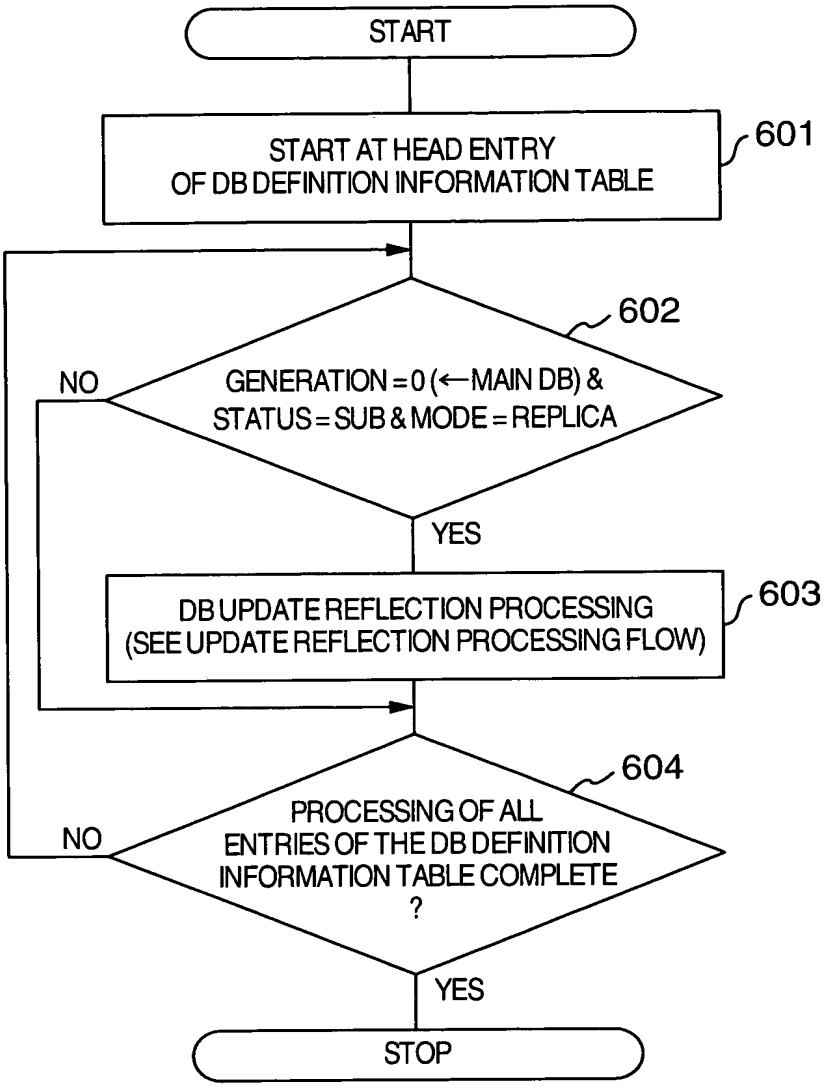
START
START AT HEAD ENTRY OF DB DEFINITION INFORMATION TABLE
601
602
NO
GENERATION = 0 (← MAIN DB) & STATUS = SUB & MODE = REPLICA
YES
DB UPDATE REFLECTION PROCESSING (SEE UPDATE REFLECTION PROCESSING FLOW)
603
604
NO
PROCESSING OF ALL ENTRIES OF THE DB DEFINITION INFORMATION TABLE COMPLETE ?
YES
STOP

FIG.7

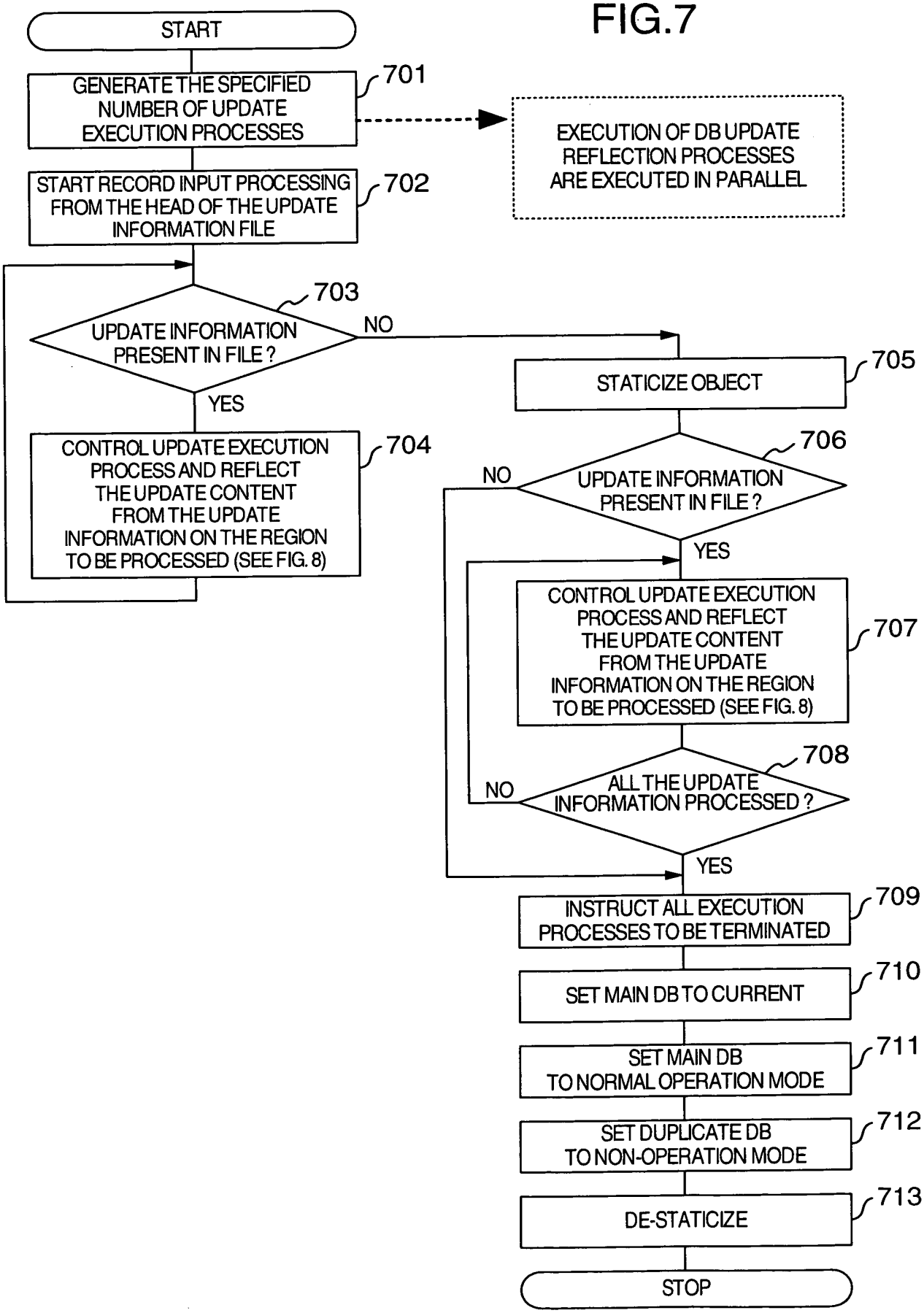
START
GENERATE THE SPECIFIED NUMBER OF UPDATE EXECUTION PROCESSES
701
EXECUTION OF DB UPDATE REFLECTION PROCESSES ARE EXECUTED IN PARALLEL
START RECORD INPUT PROCESSING FROM THE HEAD OF THE UPDATE INFORMATION FILE
702
703
UPDATE INFORMATION PRESENT IN FILE ?
NO
YES
CONTROL UPDATE EXECUTION PROCESS AND REFLECT THE UPDATE CONTENT FROM THE UPDATE INFORMATION ON THE REGION TO BE PROCESSED (SEE FIG. 8)
704
STATICIZE OBJECT
705
706
NO
UPDATE INFORMATION PRESENT IN FILE ?
YES
CONTROL UPDATE EXECUTION PROCESS AND REFLECT THE UPDATE CONTENT FROM THE UPDATE INFORMATION ON THE REGION TO BE PROCESSED (SEE FIG. 8)
707
708
NO
ALL THE UPDATE INFORMATION PROCESSED ?
YES
INSTRUCT ALL EXECUTION PROCESSES TO BE TERMINATED
709
SET MAIN DB TO CURRENT
710
SET MAIN DB TO NORMAL OPERATION MODE
711
SET DUPLICATE DB TO NON-OPERATION MODE
712
DE-STATICIZE
713
STOP

FIG.8

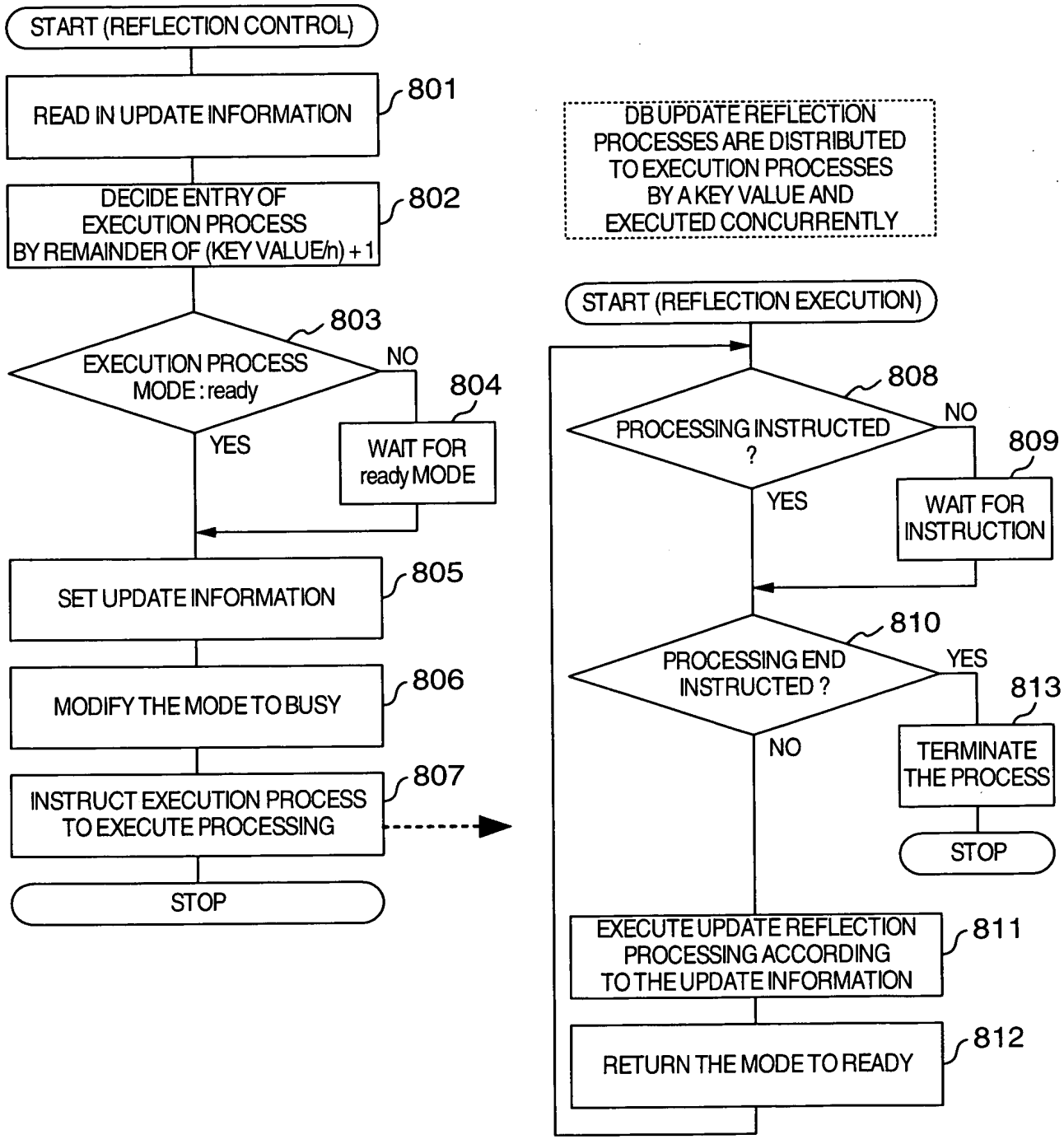
START (REFLECTION CONTROL)
READ IN UPDATE INFORMATION
801
DECIDE ENTRY OF EXECUTION PROCESS BY REMAINDER OF (KEY VALUE/n) + 1
802
EXECUTION PROCESS MODE : ready
803
NO
YES
WAIT FOR ready MODE
804
SET UPDATE INFORMATION
805
MODIFY THE MODE TO BUSY
806
INSTRUCT EXECUTION PROCESS TO EXECUTE PROCESSING
807
STOP
DB UPDATE REFLECTION PROCESSES ARE DISTRIBUTED TO EXECUTION PROCESSES BY A KEY VALUE AND EXECUTED CONCURRENTLY
START (REFLECTION EXECUTION)
PROCESSING INSTRUCTED ?
808
NO
YES
WAIT FOR INSTRUCTION
809
PROCESSING END INSTRUCTED ?
810
YES
NO
TERMINATE THE PROCESS
813
STOP
EXECUTE UPDATE REFLECTION PROCESSING ACCORDING TO THE UPDATE INFORMATION
811
RETURN THE MODE TO READY
812

FIG.9

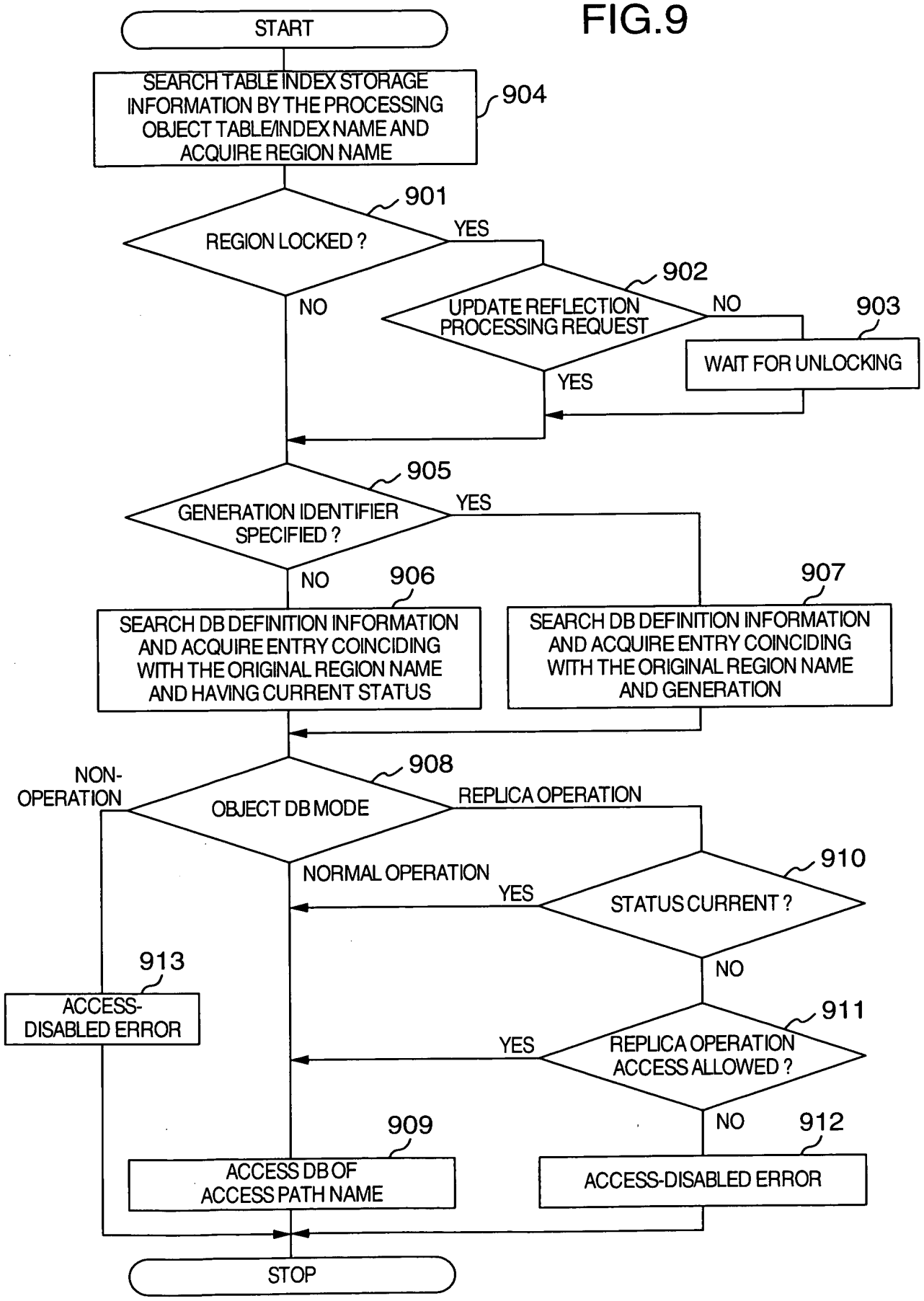
START
SEARCH TABLE INDEX STORAGE INFORMATION BY THE PROCESSING OBJECT TABLE/INDEX NAME AND ACQUIRE REGION NAME
904
901
REGION LOCKED ?
YES
NO
902
UPDATE REFLECTION PROCESSING REQUEST
NO
YES
903
WAIT FOR UNLOCKING
905
GENERATION IDENTIFIER SPECIFIED ?
YES
NO
906
SEARCH DB DEFINITION INFORMATION AND ACQUIRE ENTRY COINCIDING WITH THE ORIGINAL REGION NAME AND HAVING CURRENT STATUS
907
SEARCH DB DEFINITION INFORMATION AND ACQUIRE ENTRY COINCIDING WITH THE ORIGINAL REGION NAME AND GENERATION
908
NON-OPERATION
OBJECT DB MODE
REPLICA OPERATION
NORMAL OPERATION
910
YES
STATUS CURRENT ?
NO
913
ACCESS-DISABLED ERROR
911
YES
REPLICA OPERATION ACCESS ALLOWED ?
NO
909
ACCESS DB OF ACCESS PATH NAME
912
ACCESS-DISABLED ERROR
STOP

FIG.10

EXAMPLE OF UPDATE INFORMATION RECORD FORMAT

REGION NAME	TABLE NAME	KEY VALUE	PROCESSING TYPE	UPDATE DATA
a	table 1	0105	ADD	ADDITION DATA INFORMATION
a	table 1	0021	UPDATE	UPDATING DATA INFORMATION
a	table 1	0003	DELETE	—
⋮	⋮	⋮	⋮	⋮

FIG.11

	PROCESS NUMBER	PROCESSING MODE	UPDATE INFORMATION
#1	03	busy	UPDATE INFORMATION ON UPDATE PROCESSING
	⋮	⋮	
#REMAINDER OF (KEY VALUE/n) + 1 →			
	30	ready	UPDATE INFORMATION ON ADDITION PROCESSING
#n	⋮	⋮	